

WHAT IS CLAIMED IS:

1. A retainer for holding an optical element,
said retainer comprising:

5 a detector for detecting a deformation amount
of the optical element; and

an adjustment unit for adjusting the
deformation of the optical element based on the
deformation amount.

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2. A retainer according to claim 1, wherein said
detector is a strain gauge.

3. A retainer according to claim 1, wherein said
15 detector is arranged on the optical element.

4. A retainer according to claim 1, wherein
three detectors are arranged on the same circumference
at a pitch of 120°.

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5. A retainer according to claim 1, wherein said
adjustment unit equalizes a load applied to the optical
element.

25 6. A retainer according to claim 1, wherein said
adjustment unit adjusts the load applied to the optical
element to reduce aberration of the optical element.

7. A retainer according to claim 5, wherein said adjustment unit includes a coil spring.

5 8. A retainer according to claim 7, wherein said adjustment unit includes an adjustment screw for adjusting a length of the coil spring.

9. A retainer according to claim 1, wherein
10 three adjustment units are arranged on the same circumference at a pitch of 120° .

10. A retainer according to claim 1, further comprising a support part that supports the optical
15 element at approximately three points.

11. A retainer according to claim 1, wherein there are three detectors and three support parts, wherein each detector is arranged between two adjacent
20 supports parts.

12. A retainer according to claim 1, wherein there are three adjustment units and three support parts, wherein each detector is arranged between two
25 adjacent supports parts.

13. A retainer according to claim 1, wherein the number of adjustment units is more than the number of detectors, and said adjustment units are driven based on detection results by said detectors.

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14. A retainer according to claim 1, further comprising a support part that supports the optical element at approximately three points, wherein said adjustment unit is provided every space between
10 adjacent two points among the three points, and said detector is located at least one of the spaces among the three points.

15. A retainer according to claim 1, wherein said
15 detector and said adjustment unit are integrated with each other.

16. A retainer according to claim 1, wherein the adjustment unit includes a component, and said detector
20 detects the deformation amount by using the component in said adjustment unit.

17. A retainer according to claim 16, wherein the adjustment unit includes a component, and said detector
25 detects the deformation amount by measuring a strain amount of the component in said adjustment unit.

18. A retainer for holding an optical element,
said retainer comprising:

an adjustment unit for adjusting a shape of
the optical element, said adjustment unit including a
5 component; and

a detector for detecting a deformation amount
of the component in said adjustment unit, said
adjustment unit adjusting the shape of the optical
element based on a detection result by said detector.

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19. A retainer according to claim 18, further
comprising a support part for supporting the optical
element at approximately three points, and said
adjustment units are arranged at intervals of the
15 approximately three points.

20. An adjustment method for adjusting a shape of
the optical element into a desired shape, said method
comprising the steps of:

20 obtaining the shape of the optical element;
calculating a force to be applied to the
optical element to correct the shape of the optical
element into the desired shape; and

applying the force calculated by said
25 calculating step to the optical element.

21. An adjustment method according to claim 20,
further comprising the steps of:

detecting wave front aberration of the
optical element; and

5 applying the force to the optical element so
that the wave front aberration falls within a
permissible range.

22. An exposure apparatus comprising:

10 a retainer for holding an optical element,
said retainer including a detector for detecting a
deformation amount in a shape of the optical element,
and an adjustment unit for adjusting the shape of the
optical element based on the deformation amount; and

15 an optical system for exposing a pattern
formed on a mask or reticle onto an object through the
optical element held by the retainer.

23. An exposure apparatus comprising:

20 a retainer for holding an optical element,
said retainer including an adjustment unit for
adjusting a shape of the optical element, said
adjustment unit including a component, and a detector
for detecting a deformation amount of the component in
25 said adjustment unit, the adjustment unit adjusting the
shape of the optical element based on a detection
result by said detector; and

an optical system for exposing a pattern formed on a mask or reticle onto an object through the optical element held by the retainer.

5 24. A device fabrication method comprising the steps of:

 exposing a pattern on a mask, onto an object by using an exposure apparatus that includes a retainer that includes three support parts for supporting an
10 optical element, a first unit for applying a first elastic force to the optical element in an anti-gravity direction, and a second unit, arranged opposite to the first unit through the optical element, for applying a second elastic force to the optical element in a
15 gravity direction, and an optical system for exposing a pattern formed on a mask or reticle onto an object through the optical element held by the retainer; and
 developing the object that has been exposed.

20 25. A device fabrication method comprising the steps of:

 exposing a pattern on a mask, onto an object by using an exposure apparatus that includes a retainer for holding an optical element, said retainer including
25 an adjustment unit for adjusting a shape of the optical element, said adjustment unit including a component, and a detector for detecting a deformation amount of

the component in said adjustment unit, the adjustment unit adjusting the shape of the optical element based on a detection result by said detector, and an optical system for exposing a pattern formed on a mask or
5 reticle onto an object through the optical element held by the retainer; and
developing the object that has been exposed.